ESO #1127

Costs of Financial Intermediation Under Regulations: Commercial Banks and Development Banks

Carlos E. Cuevas

September 1984

Agricultural Finance Program
Dept. of Agricultural Economics and Rural Sociology
The Ohio State University
2120 Fyffe Road
Columbus, Ohio 43210

Contents

List of Tables

Costs of Financial Intermediation Under Regulations: Commercial Banks and Development Banks

Carlos E. Cuevas*

1. Introduction

Knowledge of the characteristics of the production technology of financial institutions is essential for the analysis of market structure and institutional performance. Many regulatory and managerial decisions are based on specific assumptions about economies of scale and other features of the cost-output relationships prevailing in these institutions. Consequently, in recent years several studies on the banking system of the U.S. and other developed economies have been concerned with the technological features of financial institutions, particularly with the measurement of scale economies and cost complementarities in the production of financial services.[1/] However, very few attempts have been made to analyze these cost-output relationships in financial institutions operating in less-developed countries. In these countries, a substantial degree of regulation usually prevails thus making the knowledge of the production structure of financial institutions even more important, in order to assess the likely consequences of regulatory decisions.

Studies on development banks in less-developed countries by Gheen, and Nyanin, have provided very limited insights into the characteristics of the cost structure and underlying technology of these institutions, due to the choice of very restrictive functional forms for the cost

* I wish to acknowledge the support and encouragement of Professors Douglas H. Graham and Dale W Adams of the Department of Agricultural Economics, Ohio State University.

1/ See for example, Benston, Hanweck and Humphrey; Mullineaux; Murray and White; Panzar and Willig (1977). For a review of the pre-1970 literature, see Benston.

function. In general, the use of Cobb-Douglas or CES specifications implies the adoption of highly restrictive assumptions about the technology utilized by financial intermediaries. Under these specifications, scale economies are forced to remain constant, regardless of the output level, therefore the corresponding average cost curves are either downward or upward sloping throughout the entire output domain. In other words, under these constrained functional forms, the existence of U-shaped average cost curves is ruled out a priori.

In this paper, a translog cost function is utilized to analyze the cost-output relationships and production technology of the National Agricultural Development Bank and a large private bank in Honduras. Emphasis is placed on the measurement of costs of financial intermediation. This cost function approach also allows the measurement of scale economies and the assessment of cost complementarities (economies of scope) in the provision of banking services. In addition, the effects that financial regulations have on the costs of intermediation are analyzed.

The translog functional form has been used in a number of recent studies of scale economies and economies of scope in banking.[2/] The main advantage of this functional form is its flexibility with respect to the characteristics of the underlying technology. Many assumptions imposed by other functional forms, such as homogeneity or unitary elasticity of factor-substitution, become testable hypotheses under the translog specification. The use of this functional form is specially

2/ Benston, Hanweck and Humphrey; Benston, Berger, Hanweck and Humphrey; Murray and White.

pertinent in multi-output production, as is the case of financial institutions producing at least two different outputs, loans and deposit services, in varying proportions.[3/]

The following section presents the model utilized in this paper and its main properties. The introduction of regulation indicators in the cost function is discussed in Section 3. Data and estimation procedures are described in Section 4. Results are presented in Sections 5 through 8. The final section summarizes the main findings of the study.

2. A Translog Cost Function

Cost minimization subject to a production constraint yields a cost function that depends on output levels and factor prices. In the two-output, two-input case, this implicit function can be written as:

$$C = f(q_1, q_2, p_1, p_2), \tag{1}$$

where, q_i = quantity of ith output

q_1 : loans, q_2 : deposits

p_j : price of jth input

p_1 : salaries and wages, p_2 : price of capital services.

The translog cost function is essentially a second-order approximation to an arbitrary cost function. It is quadratic in the logarithms of output quantities and input prices, and linear in the parameters. For two outputs and two inputs, the translog function is written as follows:

3/ For a more detailed characterization of the translog function see Binswanger; Christensen, Jorgenson, and Lau; Ray.

$$\ln C = \alpha_0 + \alpha_1 \ln q_1 + \alpha_2 \ln q_2 + \beta_1 \ln p_1 + \beta_2 \ln p_2 + \frac{1}{2}\gamma_{11}(\ln q_1)^2 +$$

$$+ \frac{1}{2}\gamma_{22}(\ln q_2)^2 + \gamma_{12}\ln q_1 \ln q_2 + \frac{1}{2}\delta_{11}(\ln p_1)^2 + \frac{1}{2}\delta_{22}(\ln p_2)^2 +$$

$$+ \delta_{12}\ln p_1 \ln p_2 + \eta_{11}\ln q_1 \ln p_1 + \eta_{12}\ln q_1 \ln p_2 + \eta_{21}\ln q_2 \ln p_1 +$$

$$+ \eta_{22}\ln q_2 \ln p_2 . \qquad (2)$$

The cost-share equations for the two factor inputs derive from equation (2) as:

$$S_j = \beta_j + \Sigma_h \delta_{jh} \ln p_h + \Sigma_i \eta_{ij} \ln q_i, \quad j,h = 1,2, \quad i = 1,2, \qquad (3)$$

where S_j denotes the cost share of factor j,

$$S_j = \frac{p_j x_j}{C} = \frac{\partial \ln C}{\partial \ln p_j}.$$

Cost function (2) should be homogenous of degree one in input prices. This condition imposes a set of restrictions on the parameters of equation (2) that is also consistent with the requirement that the sum of the cost shares (3) must equal one:

$$\Sigma_j \beta_j = 1, \quad \Sigma_j \delta_{jh} = 0, \quad \Sigma \eta_{ij} = 0, \quad j,h = 1,2, \quad i = 1,2.$$

Several properties of the cost structure and the underlying production function can be investigated using the translog cost function defined in equation (2). These properties are summarized below.

Economies of Scale

Overall economies of scale, ES, are defined as the percentage change in cost when all outputs increase by a common factor, λ. In equation (2), scale economies are measured as:

$$ES = \frac{\partial \ln C}{\partial \ln q_1} + \frac{\partial \ln C}{\partial \ln q_2},$$

$$\text{i.e., } ES = \alpha_1 + \alpha_2 + \gamma_{11}\ln q_1 + \gamma_{22}\ln q_2 + \gamma_{12}(\ln q_1 + \ln q_2) + (\eta_{11} + \eta_{21})\ln p_1 + (\eta_{12} + \eta_{22})\ln p_2. \quad (4)$$

Note that scale economies are a function of the output levels, q_1 and q_2, therefore the ES measure is not invariant to scale and is dependent on the output mix. If ES is less than 1, there are economies of scale since costs increase proportionately less than output. Values of ES equal to or greater than 1 imply constant returns or diseconomies of scale respectively. Partial economies of scale, ES_i, and marginal costs of each output, MC_i, can be computed from equation (2) as:

$$ES_i = \frac{\partial \ln C}{\partial \ln q_i}, \text{ and}$$

$$MC_i = \frac{C_i}{q_i}(B_i + \gamma_{ii}\ln q_i + \gamma_{ik}\ln q_k), \quad (5)$$

where, C_i is the proportion of total costs C attributed to output i. It is computed as $C_i = g_i C$, where $g_i = (ES_i/ES)$ is the output-cost-share, evaluated at the specific levels of both outputs and all other variables involved in the cost function,[4/]

$$B_i = \alpha_i + \Sigma_j \eta_{ij}\ln p_j .$$

Cost Complementarities (Economies of Scope)

Cost complementarities exist in multi-output production when the marginal cost of producing one output declines with increases in production of another output,[5/] i.e., cost complementarity exist if:

4/ See Cuevas for a discussion of the cost-attribution problem when there is joint production.

5/ Murray and White refer to this relationship as "economies of scope". However, Benston, Berger, Hanweck and Humphrey give a more strict definition for the concept of economies of scope. See also Panzar and Willig (1981).

$$\partial(MC_i) / \partial q_k = \frac{\partial^2 C}{\partial q_i \partial q_k} < 0 .$$

This condition can be expressed in terms of the logarithms of the variables as:

$$\frac{\partial^2 C}{\partial q_i \partial q_k} = \frac{C}{q_i q_k} \left(\frac{\partial^2 \ln C}{\partial \ln q_i \partial \ln q_k} + \frac{\partial \ln C}{\partial \ln q_i} \frac{\partial \ln C}{\partial \ln q_k} \right) < 0 . \qquad (6)$$

Since C, q_i, q_k are all positive, the sign of this second derivative is determined by the expression in parenthesis. Murray and White indicate that in terms of the parameters of the cost function, a necessary condition for the existence of cost complementarity between loans and deposits is:

$$\gamma_{12} + \alpha_1 \alpha_2 < 0 \qquad (7)$$

Elasticity of Substitution and Elasticities of Input Demand

Uzawa has shown that the Allen partial elasticity of substitution between factors of production, σ_{jh}, can be written in terms of the (dual) cost function as:

$$\sigma_{jh} = \left(\frac{\partial^2 \ln C}{\partial p_j \partial p_k} / \frac{\partial \ln C}{\partial p_j} \frac{\partial \ln C}{\partial p_h} \right) + 1 . \qquad (8)$$

This expression can be transformed and expressed in terms of the parameters of the translog cost function (2) and the factor shares (S_j), so that the Allen partial elasticities of substitution can be computed as:

$$\sigma_{jh} = (\delta_{jh} + S_j S_h)/S_j S_h \ , \ \sigma_{jj} = (\delta_{jj} + S_j(S_j - 1))/S_j^2,$$

$$j,h = 1,2 . \qquad (9)$$

In addition, the price elasticities of demand for inputs, e_{jh}, can be obtained using the estimated values of σ_{ij} and the factor shares (see Binswanger).

$$e_{jj} = \sigma_{jj} S_j \ , \quad e_{jh} = \sigma_{jh} S_h \ , \quad j,h = 1,2 \ . \tag{10}$$

It is clear from (9) that if all $\delta_{jh} = 0$, then the elasticities of substitution are independent of factor prices, and equal to one for $j \neq h$.

3. Effects of Regulation

Regulation-related variables are introduced in the cost function (2) by assuming that the total demand for every factor of production X_i, can be decomposed into two parts: (a) X_{i1}, which corresponds to the level of X_i consistent with an unregulated environment; and (b), X_{i2}, an additional quantity or a differential skill that is required by existing regulations. Examples of these are additional personnel or special mechanisms devised to provide customer services that compensate for deposit-rate ceilings, and teams hired and trained to deal with specific project funds and clientele. Also, additional accounting and record-keeping personnel become necessary to comply with the reporting requirements of special credit programs. Finally, in the case of public lending institutions there are usually expanded personnel costs of featherbedded employment within the institution and additional workload (i.e. costs) of the existing staff associated with servicing political-patronage clients. The two most important financial regulations in Honduras are briefly discussed below.

Interest-Rate Ceilings

Interest-rate regulations include ceilings on deposit rates and restrictions on lending rates. Restrictions on the level of deposit rate create costs of regulation-avoidance in order to compete for

deposit mobilization. Therefore, an increase in the real deposit-rate should induce the substitution of explicit interest for implicit premia to depositors, thus decreasing the administrative costs of mobilizing deposits. Constraints on the interest rates that can be charged on loans generate costs of implementing loan procedures that allow lenders to discriminate among borrowers. The higher the ceiling on the lending rate, the more flexible and less constrained are these lending operations. Again, explicit interest charges can take the place of implicit charges, and lenders' costs can be reduced through the adoption of less-complicated loan procedures. This effect will not only reduce lenders' costs but will also benefit borrowers since transaction costs associated with borrowing will be reduced as well.

Proxy variables for the effects of interest-rate regulations are the ex-post real deposit rate $(d - \dot{p})$, and the ex-post real lending rate $(\ell - \dot{p})$, where d is the statutory deposit rate, ℓ is the interest-rate ceiling on loans, and $\dot{p}$ is the rate of inflation. The relevant expression that will be included in the cost function can be written as:

$$\lambda_1(d-\dot{p}) + \lambda_2(\ell-\dot{p}) \qquad (11)$$

where, d, $\dot{p}$, and ℓ have been defined above. The foregoing discussion about the effects of interest-rate regulations indicates that the signs of λ_1 and λ_2 should be negative.

Loan Targeting and Special Credit Projects

The most important financial intermediary dealing with targeted funds and special credit projects in Honduras throughout the period considered in this study (1971-1982) has been the National Agricultural

Development Bank (BANADESA). Only recently have some private banks participated in externally-funded projects sponsored by the World Bank, and to a lesser extent by the U.S. Agency for International Development (USAID). Therefore, the analysis of the effects of loan-targeting on intermediation costs concentrates on the development bank.

Targeted funds and special credit projects have a direct effect on lenders' costs due to the additional accounting and record-keeping personnel and materials necessary to comply with the reporting requirements of these programs. Typical sources of targeted funds in Honduras are the central bank, and donor agencies. Central-bank funds correspond mainly to crop-specific lines of credit designed to provide short-term financing to small and medium-size farms. Foreign funds usually come in the form of special projects targeted to specific activities, and tend to include a larger proportion of long-term loans. In what follows, the term "external funds" will be used to refer to both central-bank and foreign funds. The other, non-targeted, source of funds for BANADESA are demand, savings and time deposits from public-sector institutions, and from the public at large.

It is hypothesized that the effect of targeted funds on costs in the development bank includes a "ratchet" effect. That is, the increased level of costs growing out of a new credit project contracted by the bank does not decline to the previously existing cost level once the loan funds have been disbursed to the ultimate borrowers. Additional resources are employed or purchased at the beginning of the project in order to comply with the project's targeting requirements,

but these resources are not laid-off or sold once the funds are disbursed. The cost function will thus incorporate a set of variables that capture the effect of targeted funds under this "ratchet" effect hypothesis. Three indicator variables (S_i,i=1,2,3) are defined to account for the effect of the three different sources of funds: deposits, central bank, and foreign funds. In order to capture the influence of targeted funds under the "ratchet" effect hypothesis, S_i's are defined so that $S_i > 0$ if the value of funds coming from source i has increased over the level observed in the previous year, otherwise $S_i = 0$. Specifically, the value of S_i in year t (S_{it}) will follow a three-point distribution, such that:

$S_{it} = 0$, if $\Delta_{it} \leq 0$

$S_{it} = 1$, if $0 < \Delta_{it} \leq (1/2)\ \Delta_{itm}$

$S_{it} = 2$, if $(1/2)\ \Delta_{itm} < \Delta_{it} \leq \Delta_{itm}$,

where, Δ_{it} stands for the difference between the amount of funds coming from source i in year t, and the amount of these funds in year t-1,

Δ_{itm} is the maximum value of this difference observed over the period covered by the data (1971-1982).

A combined variable, S_{23} is similarly defined to account for the effect of all external funds combined (central-bank and foreign funds together). The "ratchet effect" hypothesis implies that a positive sign is expected in the coefficients of the S_i variables that capture the effects of targeted funds, i.e., central-bank and foreign funds. The estimation will consider the possibility that these effects may be lagged, particularly for foreign-donor funds, since this source of

funding is often in the form of special projects with delayed period of disbursement and expenditures. Consequently, external funds combined, and foreign funds alone are also specified with a one-year lag, to capture the lagged effect increases in these sources of funds are likely to have on costs.

Summarizing, the set of indicator variables that will enter the cost function to address the issue of loan-targeting can be written as:

$$\omega_1 S_1 + \omega_2 S_2 + \omega_3 S_3 \quad , \tag{12}$$

or alternatively:

$$\omega_1 S_1 + \omega_{23} S_{23} \quad ,$$

where, S_i's have been defined above and ω_i's are the corresponding parameters.

The variables S_2 and S_{23} are also included with a one-year lag in various regressions.

4. Data and Estimation

The estimation of the cost function draws upon two separate data sets. The first data base corresponds to 28 branches of the National Agricultural Development Bank (BANADESA) over the 12-year period 1971 through 1982. This bank is referred as the "development bank". The second data set was obtained from the largest private commercial bank of the country (Banco Atlantida), that will be referred to as the "private bank". This bank has a network of over 50 agencies and offices throughout the country, that is organized into 16 main branches with independent accounting records. The same 12-year period (1971-82) is covered by this data set. Data were gathered through the Economic Studies departments of both banks, and in many cases directly from the

branches. Financial-sector and national-income variables were recorded from Central Bank publications.

All variables have been expressed in real terms (lempiras of 1966) using the country's implicit GDP deflator. Variable definitions are briefly outlined below.

(a) Costs: total non-financial operating expenses, net of depreciation and provisions for bad debt. The sources of these data in both banks were the revenue-expenditure statements of the branches, produced by the accounting divisions.

(b) Outputs: total value of loans (q_1), and total amount of deposit balances (q_2). The definition of bank output has been a matter of controversy in the recent literature.[6/] Alternative definitions to the one utilized here are: (i) the number of loans, and the number of deposit accounts (as separate outputs), and (ii) an index of aggregate output including loans and deposits. Preliminary regressions on the data showed that the definition of value of loans, and deposit balances as separate outputs provided consistently better fits than any of the alternative definitions. This definition was therefore chosen on this basis.

(c) Factor Prices. Two factors are considered here: labor, and capital goods. The price of labor services (p_1) is measured as total personnel costs including benefits and social security payments divided by the total number of employees. A unit price of capital services (p_2) is proxied by the ratio of depreciation plus rents paid over the total value of loans plus deposit balances. This proxy was found positively

6/ See Cuevas for a discussion of these definitions.

(and significantly) correlated with the implicit deflator of gross domestic capital formation in the national accounts. A posteriori support for this proxy selection is the fact that the factor-price homogeneity condition is met in all (unrestricted) estimations of the cost function.

(d) Loan Size (LS) and Deposit Size (DS). These variables are included in the model to account for the heterogeneity of loans and deposit transactions. They are included in the cost function (2) in interactive form with the output levels:

$$\theta_1 \ln q_1 \ln LS + \theta_2 \ln q_2 \ln DS.$$

In this way, both the scale-economies indicator and the marginal costs of production become dependent on the average size of loans and deposits. Since the number of loans was not available in the private bank, loan size could not be computed for this bank.

(e) Real deposit-rate and real lending-rate. The nominal deposit rate (d) was calculated as the arithmetic mean of all deposit-rate ceilings established by the central bank. The real deposit rate is obtained by substracting the inflation rate $\dot{p}$ from the nominal deposit rate. The real lending rate is proxied substracting the inflation rate from the overall ceiling established for the nominal interest rate on loans, ℓ. The rate of inflation is calculated as the 12-month variation in the implicit GDP deflator.

Estimation of the translog cost function (2) was undertaken independently for the two banks, both as a single equation (by OLS), and as a cost system with the cost-share equations (3). Since cost shares must add to 1, one of these equations is redundant and therefore is dropped

from the system. The remaining equations in the system, the cost function and the labor-share equation, are seemingly unrelated and the estimation of this two-equation system utilizes a generalized-least-squares procedure. Joint estimation of the cost system should improve the efficiency of the parameter estimates. However, Benston, Hanweck and Humphrey argue that these gains in efficiency are relatively small and undertake their estimations using OLS on the cost function above. As will be shown later, aside from efficiency gains, there may be important differences in the magnitude of the estimated parameters resulting from different estimation procedures. As a consequence, the scale-economies measure (and other parameters) will differ depending on the estimation technique.

5. Intermediation Costs: Summary of Findings and Contrasts

A summary of some of the estimated costs of intermediation of the development bank and the private bank is shown in table 1. These results are based on the cost-system estimates reported in the Appendix, tables A.1 and A.2. The gains in efficiency due to the adoption of a system-estimation procedure were very clear in the development bank. However, they appeared less important in the private bank where multicollinearity was very high. Rows 1 and 2 of table 1 indicate the distribution of total intermediation costs in each bank between lending costs (row 1), and costs of mobilizing deposits (row 2). Rows 3 and 4 show the average and marginal costs of lending on a per-lempira basis, while rows 5 and 6 report the corresponding average and marginal costs figures for the costs of deposit mobilization. Finally, overall

Table 1. Lender's Intermediation Costs: Lending Costs and Costs of Mobilizing Deposits. Summary of Findings for the Development Bank and the Private Bank.

Cost Concept	Development Bank (%)	Private Bank (%)
1. Share of Lending Costs in Total Intermediation Costs	71.1	28.3
2. Share of Deposit-Mobilization Costs in Total Intermediation Costs	28.9	71.7
Costs of Lending		
3. Average Costs	10.02	3.39
4. Marginal Costs	7.64	1.69
Costs of Mobilizing Deposits		
5. Average Costs	8.78	5.33
6. Marginal Costs	2.72	6.71
Overall Lender's Intermediation Costs[a/]		
7. Average Costs	18.80	8.72
8. Marginal Costs	10.36	8.40

Source: Results of cost-system estimations, table A.1 (model 2) and table A.2 (model 2) in the Appendix, evaluated at geometric means of the variables in the models.

a/ Lending Costs + Costs of Deposit Mobilization

intermediation costs (lending costs plus deposit-mobilization costs) are reported in rows 7 and 8 of table 1.

The first important contrast between the two banks is shown in rows 1 and 2 of table 1. Over 70% of the development-bank's costs of intermediation correspond to lending activities, whereas only 29% of its costs are attributed to the administration of deposit accounts. The opposite is true for the private bank, where only 28% of the costs are associated with lending, while 72% of the bank's total intermediation costs are related to deposit mobilization. This acute contrast reflects the development-bank's greater reliance on foreign funds and special rediscount lines from the central bank, as compared to the private bank which relies more heavily upon financial resources mobilized from the general public.

Over the period under analysis (1971-1982), an average of 51% of the loan-portfolio of the development bank was funded through foreign funds or central-bank rediscount lines. Furthermore, these external (non-deposit) sources of funds have grown in relative importance with respect to the loan-portfolio from a 44%-average in the period 1971-1974 to a 57%-average in the period 1979-1982. Consequently, the proportion of the total value of new loans funded through deposit mobilization decreased from an average of 56% in the period 1971-1974, to a 43%-average in the last four years of the series. On the other hand, the private bank has relied primarily upon deposits mobilized from the general public to finance its loan portfolio. This bank's access to rediscount lines at the central bank has been limited, and only recently has it engaged in foreign-funded special credit projects. In 1981, a

representative year according to bank officials, 91% of the loan portfolio was funded with own deposits, almost 7% came from central-bank rediscount funds, and a little over 1% from foreign funds (primarily World Bank projects). This sharp contrast in the composition of the banks' liabilities has a counterpart in the allocation of real resources in each bank, that is reflected in the participation of lending and deposit activities in total intermediation costs.

Costs of lending show a second striking contrast between the two banks. The estimated average costs of lending are 10% for the development bank, three times as high as those estimated for the private bank (3.39%). The marginal costs of lending are 4.5 times larger in the development bank (7.6%) than in the private bank (1.7%). This is again reflecting the differences in the sources of funds with which the banks operate. The greater reliance on external funds by the development bank implies the acceptance of loan-targets imposed by foreign donors, international lenders, and/or the government. These targets typically imply servicing a more risky and numerous clientele, and a high incidence of relatively small loans. Also, targeted funds are accompanied by monitoring, supervision, and reporting requirements that force the institution to maintain a more centralized operation, and a heavier incidence of supervisory and record-keeping resources, than would be the case in the absence of these targeting requirements.

It is important to note that the cost estimates reported in table 1 do not include provisions for bad debts, thus representing a lower-bound estimate for the operational spread that these institutions would require in order not to suffer operational losses. In this sense, the

results obtained for the development bank are particularly striking, especially when comparing these results with the margins contemplated in credit projects funded by external agencies or the central bank. These funding sources usually allow only 3 to 4 percentage points to cover the administrative costs associated with the on-lending of their funds. Thus, to operate with these special lines of credit the development bank experiences an operational loss of over 6%, assuming that all loans are fully repaid.

The foregoing results highlight the existence of a policy inconsistency, in the sense that external donors and/or the government impose on the development bank costly loan-targets without appropriate support to service these target-groups. The costs of servicing a more risky, more numerous, and more costly clientele, for which the institution is reimbursed only at a margin of 3 or 4 percentage points, seriously compromise the financial viability of the institution. It is interesting to note that the usual 3-4% margin is closer to the average lending costs observed in efficient private commercial banks like the one under study here, than to the average lending costs observed in the development bank. However, as it has been documented elsewhere, the average cost of lending for the private bank increases substantially when dealing with foreign-funded credit projects (Graham and Cuevas). The average cost of agricultural loans made by the private bank with World Bank funds has been estimated at 8.4% ignoring default risks, a figure that exceeds by far the 4%-spread allowed in these credit projects for loan-administration costs.

The average costs of mobilizing deposits are also higher in the development bank as compared to the private bank (row 5 in table 1). However, marginal costs of deposit-mobilization show the opposite pattern, they are lower in the development bank than in the private bank (row 6 in table 1). Note also that the private bank has gone beyond the minimum average cost level in its deposit activity, since the marginal costs of deposit-mobilization appears higher than the corresponding average cost. That is, this bank has reached a point of decreasing returns to further expansions of the deposit-mobilization activity, unless this expansion relies upon increasingly large average deposit-balances (see effects of deposit-size on the bank's costs in table A.2). At the other extreme, the development bank is operating on the steep-downward-sloping section of a hypothetical average-cost curve for deposit-mobilization, considering the large difference between average costs and marginal costs observed in table 1. This difference between average costs and marginal costs should be attributed primarily to under-utilized fixed or quasi-fixed resources in the structure of the bank.

Overall, intermediation costs are higher in the development bank than in the private bank (rows 7 and 8 in table 10). However, this difference is more important in terms of the total average costs of operation than it is in terms of the marginal costs of intermediation. The relationship between the levels of average costs and marginal costs in the development bank reflects under-utilization of existing resources, whereas the private bank appears very close to its minimum-cost level of activity (marginal cost almost equals average cost). Marginal costs of

intermediation in the development bank are only two percentage points higher than in the private bank, according to the estimates reported in table 10. This result indicates that the differences in efficiency are not too substantial between the two banks. However, an important implication is that marginal-cost pricing would imply large operational losses for the development bank, whereas in the case of the private bank it would represent an almost break-even situation. From a policy-making point of view, if operational margins were administered so that the development bank could cover its marginal costs of intermediation, this bank would still experience substantial losses, since its average costs exceed by far its marginal costs. Under such a policy however, the private bank would earn a profit since its average costs are lower than the marginal costs of the development bank.

5.2. Economies of Scale, Cost Complementarities, and Factor Substitution

Economies of Scale

The importance of output definition, functional form, and the procedure utilized to estimate the parameters of the cost function, in terms of the resulting scale-economies indicators, is thoroughly discussed in Cuevas. In the two banks, the results obtained with the preferred estimation approaches, system estimation of translog cost functions, generate estimates of economies of scale that are not significantly different from one. The important contrast however, is that in the development bank the point estimate of economies of scale is close to one (1.07), whereas in the private bank this point estimate is considerably greater than one (1.59). In the former case, a 10%-increase

in the production of both outputs (loans and deposits) will generate a 10.7%-increase in total administrative costs of the development bank. In the private bank, the same 10%-increase in both outputs will create an increase in total administrative costs of 15.9%.

A more direct way of portraying the effects of scale and output-mix on the values of economies-of-scale measures is computing these values for branches of different sizes in each bank. This exercise is summarized in table 2, that shows the values of partial economies of scale (percentage change in costs with a 1% change in one output), and overall economies of scale (change in costs as a result of a change in the production of both outputs), for the two banks. Different (real-life) branch-size cases have been selected in both banks, in order to assess the main similarities and contrasts between banks and branch-sizes. Partial and overall economies of scale computed at the sample means of each bank are also reported in table 2.

A first contrast between the two banks is found in the values of the overall scale-economies indicators (rows 3 and 6 in table 2). The magnitudes of the estimated indicators for the two branch-sizes of the development bank denote the existence of a U-shaped overall average-cost "curve" (indeed a cost-surface), with the small branch lying on the downward sloping portion of this "curve", and the large branch located on the upward sloping section of this surface. The results obtained for the private bank however, indicate that even the small branch would be experiencing "diseconomies" associated with overall output expansion. A representation of the private bank's average cost would be a surface

Table 2. Estimated Values of Partial and Overall Economies of Scale (ES), at the Sample Means and at Different Branch-Sizes. Development Bank and Private Bank

Bank, Economies-of-Scale Measure (ES)	Level of Evaluation: Sample Mean (1)	"Small" Branch Case (2)	"Large" Branch Case (3)
Development Bank[a/]			
Partial ES ($\partial \ln C/\partial \ln q_i$)			
(1) ES_1, Loans	0.77	0.66	1.14
(2) ES_2, Deposits	0.31	0.30	0.40
(3) Overall ES ($\Sigma_i \partial \ln C/\partial \ln q_i$)	1.08	0.96	1.54
Private Bank[b/]			
Partial ES ($\partial \ln C/\partial \ln q_i$)			
(4) ES_1, Loans	0.39	0.22	0.67
(5) ES_2, Deposits	1.20	1.05	1.42
(6) Overall ES ($\Sigma_i \partial \ln C/\partial \ln q_i$)	1.59	1.27	2.09

a/ Computed from table A.3 (model 2) in the Appendix. Branch-size cases selected on the basis of loan activity, 1982.

b/ Computed from table A.4 (model 2) in the Appendix. Branch-size cases selected on the basis of loan and deposit activity, 1982.

with positive slopes for all movements that imply proportional expansions of both outputs.

The expression "overall expansion" needs to be underlined in the foregoing discussion since, as is evident from table 2, there exist substantial differences in the separate cost-effects of the expansion of different outputs. Furthermore, these differential effects of output expansions vary across banks. For the development bank, there exist substantial economies of scale to the expansion of deposit-mobilization activities. The partial scale-economies value of 0.31 computed at the sample mean (row 2, column 1 in table 13) indicates that a 10%-increase in deposit balances mobilized by the bank generates only a 3.1%-increase in administrative costs. On the other hand, the lending activities of this development bank are approaching constant returns-to-scale for the average-branch case[7/], and display diseconomies of scale in branches with large amounts of funds lent (row 1, column 3). The opposite pattern is observed for the private bank in table 2. This bank's lending is the activity that shows cost-advantages as compared to deposit mobilization. In all cases, an expansion in the private bank's lending of 10% would generate small-to-moderate increases in administrative costs, depending on the branch size (2.2% in the small branch, to 6.7% in the large branch). In contrast, the same expansion in the private bank's deposit-mobilization activity would create a cost increase between 10.5% (small branch) and 14.2% (large branch).

The general conclusion of the foregoing analysis is that the two banks could benefit from "economies of scale" by engaging in unbalanced

7/ i.e., a hypothetical branch that could be described by the sample means of all variables.

output-expansion. In brief, each bank should expand relatively more the activity with the lowest value of the partial scale-economies measure, i.e., the output whose expansion generates the smallest cost increase. Expansion strategies for the development bank should emphasize deposit mobilization over lending activities. On the other hand, the private bank's expansion strategies should be biased towards lending operations. With deposit-mobilization expanding at a slower pace than lending, the overall (weighted) economies-of-scale indicator for this bank should approach unity.

Cost Complementarities (Economies of Scope), and Elasticities of Factor Substitution and Factor Demand

Several parameters associated with the underlying technology of production are derived from the estimated parameters of the cost function. The relationships that allow the derivation of these results were discussed in section 2. Table 3 reports these results for the two banks under study. The necessary condition for the existence of cost-complementarities indicated by Murray and White is met in the two banks (row 1 in the table). In addition to the satisfaction of this necessary condition for cost complementarity, no further conclusions can be derived from the numerical values reported in table 3, row 1, since there are no specific units associated with these estimated parameters. Notwithstanding this limitation, these results indicate that, for the two banks, joint production of loans and deposits offers cost-advantages as compared to specialized single-output activity. This argues against the widespread "development" strategy of creating specialized lending institutions with no deposit-mobilization functions. Without

Table 3. Cost Complementarities in Production (Economies of Scope), Elasticities of Factor Substitution, and Price-Elasticities of Demand for Factors of Production, Derived from Cost-Function Estimates. Development Bank and Private Bank.

Estimated Parameters	Development Bank[a/]	Private Bank[b/]
1. Cost Complementarities, $(\gamma_{12} + \hat{\alpha}_1\hat{\alpha}_2)$	-0.4393	-0.8651
2. Elasticity of Factor-Substitution between Labor and Capital, σ_{12}	0.6328	1.2419
3. Price-Elasticities of Demand for Factors of Production, e_{ij}		
e_{11} (demand for labor, price of labor)	-0.4493	-0.8693
e_{12} (demand for labor, price of capital)	0.4493	0.8693
e_{22} (demand for capital, price of capital)	-0.1835	-0.3726
e_{21} (demand for capital, price of labor)	0.1835	0.3726

a/ Computed from cost-system estimates, table A.1, model 2.

b/ Computed from cost-system estimates, table A.2, model 2.

necessarily altering their initial goals and objectives, these institutions would be better off in terms of costs and financial liability with the provision of multiple services to their clientele.

The elasticity of substitution between labor and capital, σ_{12}, computed using the estimated parameters of the cost function and reported in table 3 (row 2) appear relatively low for the development bank, even though there are no appropriate points of reference in the literature revised. The result obtained for the private bank ($\hat{\sigma}_{12}=1.24$) is almost twice as high as the value reported for the development bank ($\hat{\sigma}_{12}=0.63$). For comparison, the values reported by Murray and White for British Columbia credit unions ($\hat{\sigma}_{12}=1.74$) are even higher than the elasticity of substitution found here for the private bank. However, their results imply price-elasticities of demand for factors of production of a magnitude similar to those calculated here in the case of the private bank.

In general, the private bank shows a higher value of the elasticity of substitution between factors of production, and factor demands more price-elastic than the development bank. These results denote a greater flexibility of the private bank in the allocation of productive resources, and a larger response to factor-market signals, as compared to the development bank. As expected, in both cases the demand for labor services shows a higher price-elasticity than the demand for services of capital goods. Overall, the results presented in table 3 reflect a more rigid structure of operations in the development bank, and a less important role of market signals in this bank's resource allocation, as compared to the private bank. As will be discussed later at greater length, the management of a development bank operates in an environment

subject to pressures and constraints that at times induces decisions independent of market considerations.

7. Interest-Rate Regulations and Lenders' Intermediation Costs

In this section, the effects of interest-rate regulations on the banks' administrative costs are analyzed, including in each bank's function the real deposit-rate and the real lending-rate as proxies for the interest-rate restrictions imposed on financial intermediaries. It is useful to recall here the expression that includes these two proxy-variables:

$$\lambda_1(d - \dot{p}) + \lambda_2(\ell - \dot{p}) \qquad (11r)$$

where, d is the nominal deposit-rate,

ℓ is the nominal ceiling on the lending rate,

$\dot{p}$ is the inflation rate.

Table 4 summarizes the results obtained in the estimation of the effects of interest-rate regulations on bank's non-financial costs. For the two banks (panels A and B), rows 1 and 2 indicate the estimated coefficients obtained including in the cost function the real deposit-rate (row 1), or the real lending-rate ceiling (row 2). Row 3 of the two panels in table 4 show the estimated parameters obtained when the real deposit-rate and the real lending-rate ceiling are specified in the cost function.

In general, the results presented in table 4 indicate that there is an inverse relationship between the levels of real interest-rates and the costs of financial intermediation. Increases in the levels of the real deposit-rate or the real lending-rate will generate reductions in

Table 4. Effects of Interest-Rate Regulations on Lenders' Intermediation Costs: Estimated Parameters of the Real-Deposit Rate, and the Real Lending-Rate in Different Equations. Cost-system Estimates for the Development Bank and the Private Bank.[a/]

Bank (model)	Parameter, Variable: λ_1, $(d - \dot{p})$: real deposit-rate ceiling — Estimate (asymptotic t-ratio)	Parameter, Variable: λ_2, $(\ell - \dot{p})$: real lending-rate ceiling — Estimate (asymptotic t-ratio)	Weighted R-square of the cost-system	F-test of Joint Null Hypothesis: $\lambda_1 = 0$, $\lambda_2 = 0$	t-test of Null Hypothesis: $\lambda_1 + \lambda_2 = 0$
	(1)	(2)	(3)	(4)	(5)
A. Development bank					
(1)	-0.0383 (-8.48)*	--	0.78	--	--
(2)	--	-0.0263 (-9.71)*	0.78	--	--
(3)	0.0345 (4.33)*	-0.0584 (-10.32)*	0.83	68.93*	-4.84*
B. Private bank					
(1)	-0.0214 (-5.58)*	--	0.97	--	--
(2)	--	-0.0008 (-0.26)	0.95	--	--
(3)	-0.0153 (-1.80)	-0.0052 (-0.81)	0.97	15.16*	-4.97*

a/ Other parameters of the cost function not reported. See basic specifications in table A.3 (development bank) and table A.4 (private bank), in the Appendix.

* : significant at 0.01 level
† : significant at 0.05 level

total intermediation costs of the banks. On the other hand, interest-rate restrictions that reduce the levels of the real deposit or lending rates will have cost-increasing effects on the financial intermediaries.

For the development bank, panel A in table 4, the real deposit-rate and the real lending-rate ceiling show negative and statistically significant coefficients when included in separate regressions (rows 1 and 2). The sign of the real deposit-rate becomes positive when this variable is included together with the real lending rate (row 3), a result that is probably a consequence of the high correlation between these real rates. Despite this difficulty, it is pertinent and revealing to test for the effect of a simultaneous change in both the real deposit-rate and the real lending-rate ceiling, i.e., a change that policy-makers could claim is "spread-neutral". This test for the combined effect of changes in the two rates ($\lambda_1 + \lambda_2$) indicate that the net effect on the development bank's costs will be of opposite sign and significantly different from zero (see column 5). For example, using the results reported in row 5 of panel A, the net effect of a one-point increase in both the real deposit-rate ceiling and the real lending-rate ceiling would be a reduction of 2.4% in total intermediation costs of the bank[8/] ($\hat{\lambda}_1 + \hat{\lambda}_2 = -0.024$, t-ratio = -4.84). Note that the sign and magnitude of the combined effects of simultaneous changes in deposit and lending rates ($\hat{\lambda}_1 + \hat{\lambda}_2$) is not too different from the individual effects of each of these variables when included in separate equations (rows 1, 2, and 3). Therefore, it is possible to conclude that changes in the real deposit-rate ceiling and the real lending-rate ceiling will bring about changes in total intermediation costs of the development bank in

8/ i.e., approximately 0.35 million lempiras in 1982.

the opposite direction of 2 to 3% per unit of change in the real interest-rate ceilings.

The results obtained for the private bank (panel B in table 4) are similar to the findings discussed above for the development bank. In the private bank, the estimated parameters for the real deposit-rate ceilings show negative signs and are statistically significant in the two equations including this variable (rows 1 and 3, column 1). The test performed for the combined effect of simultaneous changes in the real deposit-rate ceiling and the real lending-rate ceiling (row 3, column 5) indicates that this combined effect has a negative sign and is significantly different from zero ($\hat{\lambda}_1 + \hat{\lambda}_2 = -0.0205$, t-ratio = -4.97). This result is similar to that obtained in the same test performed for the development bank. A simultaneous increase in both the real deposit-rate ceiling and the real lending-rate ceiling of one percentage point will generate a 2.05%-decrease in total intermediation costs of the private bank.[9/]

The general conclusion that derives from the foregoing analysis is that interest-rate regulations are an important determinant of non-financial intermediation costs in the financial institutions under study. According to these results, interest-rate restrictions that translate into reductions in the real ceilings imposed on deposit and lending rates generate significant cost increases to the financial intermediaries. It is important to note that the cost increases borne by lenders estimated in this section are only a lower-bound estimate of the total cost-effects of interest-rate restrictions. Part of these total cost-effects are passed-on by the financial intermediaries

9/ i.e., about 0.8 million lempiras in 1982.

primarily to borrowers, under the form of transaction costs associated with loan procedures established by lenders.10/

8. Loan-Targeting and Lenders' Intermediation Costs in the Development Bank

This section discusses the effects of loan-targeting on the intermediation costs of the development bank. The mechanisms through which targeted funds create additional costs for the financial intermediaries, as well as the methodological approach adopted for this analysis, have been described in previous sections. Targeted funds are identified as funds obtained from central-bank rediscount lines, or from foreign donors. The term "external funds" is utilized here to refer to both central-bank and foreign funds combined. Non-targeted funds are demand, savings, and time deposits captured from public institutions and from the general public.

An analysis of the relationships between the sources of funds and portfolio composition may be summarized as follows: (a) the growing share of external sources of funds (largely directed towards agriculture) throughout the period 1971-82 has not been reflected in a significant change in the relative role of agricultural loans in the portfolio. The fungibility of finance is at work here, with external funds substituting for own-deposit funds that have been transferred from agricultural to non-agricultural loans. (b) The increased share of external funds may have induced the re-allocation of non-targeted funds to increasingly larger-sized loans in the non-agricultural sector. This cost-saving adjustment compensates for the increasing costs of handling

10/ An analysis of borrowing-transaction costs is included in Cuevas.

a growing proportion of external funds in the "targeted" portion of the loan portfolio.

The cost-function estimates including expression (12) to capture the effects of different sources of funds on intermediation costs are presented in table 5. Model 1 in this table includes the indicator variable for non-targeted funds (own-deposits, S_1), and the lagged combined effect of external funds (central bank and foreign funds). Model 2 also includes the non-targeted-funds variable, but separates the effect of (current-year) central bank funds from those of foreign funds with a one-year lag.

The estimated coefficients for the variable that captures the effects of increases in the amount of non-targeted funds (S_1, deposits) are not statistically different from zero, with very low asymptotic t-ratios in both models. Targeted funds show significant cost-increasing effects, whether they are included as a combined variable (column 1), or as separate effects (column 2). Given the typical features of central-bank and foreign-funded projects, model 2 is a more appropriate representation of these targeting schemes than model 1. The results of model 2 indicate that increases in central-bank funds will have a contemporaneous cost-increasing effect on the development bank ($\hat{\omega}_2 > 0$), given the short-term nature of the targeted programs funded through rediscount lines of the central bank. On the other hand, additional funds originated in foreign sources, usually targeted to medium-to-long-term activities with extended periods of disbursement, will exercise a cost-increasing effect with a one-year lag ($\hat{\omega}_3 > 0$ for $S_{3(t-1)}$).

Table 5. Effects of Loan-Targeting on the Intermediation Costs of the Development Bank: Estimated Coefficients for Different Sources of Funds.[a/]

Source of Funds, Parameter	Estimated Coefficients in Different Models[b/] (1)	(2)
Non-targeted funds		
ω_1, deposits (S_1)	0.0056	0.0145
	(0.31)	(0.76)
Targeted funds		
ω_2, central bank (S_2)		0.1129
		(4.20)*
ω_{23}, lagged central bank and foreign ($S_{23(t-1)}$)	0.0756	
	(2.81)*	
ω_3, lagged foreign funds ($S_{3(t-1)}$)		0.0525
		(1.94)†
Weighted R-square of the cost system	0.73	0.74
F-test of Joint Null Hypothesis: $\omega_i = 0$, all i	3.13†	5.30*

a/ Cost-system estimation, other parameters of the cost function not reported. See basic specification of the cost function in table A.3.

b/ Asymptotic t-ratios in parenthesis.

* : significant at 0.01 level
† : significant at 0.05 level

In summary, these results support the hypothesis that there is a lagged, "ratchet"-type effect of targeted funds on the intermediation costs of the development bank. Overall intermediation costs are increased as a result of additional funding received from external sources. This effect is more significant in the case of rediscount lines of credit coming from the central bank than in the case of foreign-funded projects. On the other hand, greater reliance on deposits as a source of loan-funds will not affect overall intermediation costs of the development bank.

8. Summary and Conclusions

This study has investigated the costs involved in financial intermediation in a small lesser developed economy. Aside from the explicit costs of finance, interest rates, all participants in financial markets use real resources when performing their roles in financial intermediation: savings mobilization, lending, and borrowing. The non-interest transaction costs borne by financial intermediaries have been the focus of this study. The effects of financial regulation on these transaction costs were also addressed. Among these, interest-rate regulations and selective credit policies emphasizing agricultural credit received major attention.

Financial-intermediaries' cost functions were the basis for measuring and analyzing the costs incurred by these institutions. Several characteristics of the underlying technology of banks were assessed through these cost-function estimates: scale economies, economies of scope (cost complementarities), elasticities of factor substitution and factor demand.

Banks analyzed were the National Agricultural Development Bank of Honduras (BANADESA), and the largest private commercial bank in the country. The estimation and analysis of the cost functions of these financial institutions were based on branch-level data of the two banks.

Intermediation Costs

Estimation of lenders' intermediation costs indicated that these costs are considerably higher than is usually assumed. At the same time, there were important differences between the costs of deposit-mobilization and those associated with lending. Also, the findings revealed notorious contrasts across institutions (i.e. the development bank versus the private bank). All results summarized below are based on translogarithmic cost functions, estimated by seemingly unrelated regressions (GLS), with bank outputs defined as the value of loans and deposit balances.

For the development bank, over 70 percent of intermediation costs corresponded to lending, whereas less than 30 percent were attributed to the administration of deposit accounts. The opposite is true for the private bank, where only 28 percent of the costs were associated with lending, while 72 percent were related to deposit mobilization. This acute contrast reflects the development-bank's greater reliance on foreign funds and special rediscount lines from the central bank, as compared to the private bank which relied more heavily upon financial resources mobilized from the general public.

The average costs of lending in the development bank (10%) were almost three times as high as those estimated for the private bank (3.4%). The marginal costs of lending were 4.5 times larger in the

development bank than in the private bank (7.6% versus 1.7%). This again reflects the differences in the sources of funds with which each bank operates. The greater reliance on external loan sources by the development bank created additional costs of compliance with loan-targeting requirements imposed by foreign donors or the government. These in turn forced the institution to maintain a more centralized operation, and a heavier incidence of supervisory and record-keeping resources than would have been the case in the absence of these targeting requirements. The results obtained for the development bank indicate that the usual administrative margins contemplated by foreign donors for special credit projects (3 or 4%) are unrealistically low, and compromise the financial viability of lending institutions participating in these "targeted" programs.

The average costs of mobilizing deposits were also higher in the development bank compared to the private bank (8.8% versus 5.3%). On the other hand the marginal costs of deposit-mobilization showed the opposite pattern. These were lower in the development bank (2.7%) than in the private bank (6.7%). Furthermore, deposit mobilization in the private bank had reached a point of decreasing returns. Further expansion of the deposit-mobilization activity in the private bank is an unattractive option, unless this expansion relies upon larger-sized average deposit balances. In sharp contrast, the results for the development bank highlight the existence of excess capacity unexploited for deposit mobilization, i.e. the marginal costs of deposit mobilization (2.7%) were well below the average costs (8.8%).

Overall, intermediation costs were higher in the development bank than in the private bank. However, the difference between the average costs was larger than the difference between the marginal costs of intermediation. The latter were only two percentage points higher in the development bank than in the private bank, thus indicating a similar degree of economic efficiency in terms of marginal cost criteria. Marginal cost criteria are frequently used as efficient pricing strategies. However, in this case any policy emphasizing marginal cost pricing would represent large operational losses for the development bank (given its much higher average costs), whereas in the case of the private bank this policy would imply an almost break-even situation.

Evidence on Scale and Scope Economies

Scale-economies estimates for both banks were not significantly different from one, even though the estimated levels (i.e. the elasticity of costs to increases in output) were consistently lower in the case of the development bank. These results of non-significant scale economies were not surprising, considering the small size of financial markets in low-income countries. An important finding was the substantial difference in the separate effects of the expansion of different outputs on intermediation costs. For the development bank, there were important economies of scale to the expansion of deposit-mobilization activities, whereas lending activities were approaching constant returns-to-scale for the average-branch case. The opposite was found for the private bank, where the expansion of lending activities showed cost advantages as compared to deposit mobilization. These different cost effects of different outputs indicate that both banks could benefit

from "economies of scale" by engaging in unbalanced output expansion. Expansion strategies for the development bank should emphasize deposit mobilization over lending activities, whereas the private bank's expansion should be biased towards lending operations.

Both banks show cost complementarities (economies of scope) associated with the joint production of loans and deposits. This finding argues against the strategy of creating a specialized lending institution with no deposit-mobilization functions. The joint provision of deposit services will not only improve the financial viability of the institution and promote financial savings, but also will reduce the marginal costs of lending through cost-complementarity effects.

Interest-Rate Restrictions and Loan Targeting

Interest-rate restrictions that reduced the level of real deposit rates or real lending rates had cost-increasing effects on financial intermediaries. This strongly suggests that increases in the level of real rates of interest would generate reductions in total intermediation costs. This trade-off between real rates and costs reflects the costs of regulatory-avoidance. Restrictions on deposit-rates force financial intermediaries to offer non-interest rewards to depositors in order to at least maintain their deposit balances. This is particularly important in the Honduran case, where real deposit-rates have been low (usually negative) and unstable, thus discouraging the holding of financial savings. The provision of free banking services or preferential treatment in loan contracts to selected clients generate additional costs of deposit-mobilization for the institution, that could be avoided if explicit interest compensation could be paid to depositors.

On the other hand, multiple ceilings on lending rates constrained the ability of financial intermediaries to discriminate between potential borrowers in Honduras. In response to these constraints, financial institutions created rationing mechanisms of more complicated loan procedures that substituted for a more flexible interest-rate environment. This, in effect, passed on to borrowers a substantial part of the costs of intermediation. However, a proportion of these additional costs had to be borne by the lender, and this was reflected in the inverse relationship estimated between real lending-rate ceilings and lenders' intermediation costs.

Loan targeting was found to be a cost-increasing factor affecting the development bank. Both foreign-funded projects and central-bank rediscount lines created additional intermediation costs, due to the increased resources that the bank devoted to accounting, monitoring, record-keeping and reporting, in order to comply with the requirements of targeted programs.

Conclusions

Financial intermediation costs in Honduras are substantial and vary widely depending on the conditions under which financial intermediaries and borrowers operate. These transaction costs associated with deposit-mobilization, lending, and borrowing were two or three times the level of the deposit rates of interest received by savers. Part of the intermediaries' costs were explained by various forms of non-interest compensation paid for financial savings by intermediaries. In general, however, a good proportion of total intermediation costs have been

introduced into the financial system through the impact of financial regulations.

An important implication of the results discussed here is that financial market regulations will not be effective, or their effects will be distorted by the regulatory circumvention response of financial intermediaries. The only certain effect of regulation was the increase of intermediation costs. Financial intermediaries will respond to deposit-rate ceilings through non-interest rewards to depositors. At the same time, they will counteract lending-rate ceilings through implicit pricing.

Only when the overall intensity of financial regulations restrict the ability of financial intermediaries to implicitly compensate depositors, will the total price received by savers decrease. This may have been one of the reasons underlying the decline in financial activities observed in Honduras after 1978.

Policy-makers should consider both the real effectiveness and the costs of financial regulations when evaluating policy measures. The Honduran experience strongly suggests that for many of these measures costs will offset benefits, due to the effects of regulatory circumvention. The development bank analyzed here provides a good example of the cost-increasing effects of creating a specialized institution to deal with agriculture. The usual social benefits that may be argued in support of this institution should be weighed against the less widely recognized social costs of maintaining and subsidizing these costly operations. In the end, taxpayers are providing the resources to cover

the bank's operational losses, thus distributional effects attributed to the institution should be adjusted accordingly.

Transaction costs are a measure of the "friction" existing in the functioning of financial markets. The higher the costs of intermediation, the less efficient the performance of the financial sector in resource allocation and distribution. This study has shown that there are several ways in which transaction costs can be reduced, thus reducing the friction and improving financial-markets performance. Financial reforms that provide a more flexible interest-rate environment and reduce the cost-increasing burden of targeting schemes should greatly benefit the overall performance of the Honduran financial system. Maintaining the present set of financial regulations and targeting requirements will reduce potential resource mobilization within the Honduran financial sector and only add to the real costs of financial intermediation.

References

Benston, George J., "Economies of Scale of Financial Institutions", Journal of Money, Credit and Banking, 4 (May 1972), 312-341.

Benston, George J., Gerald A. Hanweck, and David B. Humphrey, "Scale Economies in Banking. A Restructuring and Reassessment", Journal of Money, Credit and Banking, 14 (November 1982), 435-456.

Benston, George J., Allen N. Berger, Gerald A. Hanweck, and David B. Humphrey, "Economies of Scale and Scope in Banking", Board of Governors of the Federal Reserve System (June, 1983).

Binswanger, Hans P., "A Cost Function Approach to the Measurement of Factor Demand and Elasticities of Substitution", American Journal of Agricultural Economics, 56 (May 1974), 377-386.

Christensen, L. R., D. W. Jorgenson, and L. J. Lau, "Trascendental Logarithmic Production Frontiers", Review of Economics and Statistics, 55 (February 1973), 28-45.

Cuevas, Carlos E., "Intermediation Costs and Scale Economies of Banking Under Financial Regulations in Honduras", Ph.D. Dissertation, Ohio State University, 1984.

Gheen, William E., "Development Banks: Empirical Derivation of the Loan Administration Cost Curve", Ph.D. Dissertation, University of Maryland, 1976.

Graham, Douglas H., and Carlos E. Cuevas, "Lending Costs and Rural Development: Is Cheap Credit Really Cheap?", Savings and Development, 8 (forthcoming, 1984).

Mullineaux, Donald J., "Economies of Scale and Organizational Efficiency in Banking: A Profit-Function Approach", Journal of Finance, 33 (March 1978), 259-280.

Murray, John D., and Robert W. White, "Economies of Scale and Economies of Scope in Multiproduct Financial Institutions: A Study of British Columbia Credit Unions", Journal of Finance, 38 (June 1983), 887-902.

Nyanin, Ohene O., "Costs of Agricultural Lending, Institutional Viability, and Lender Behavior in Jamaica", Ph.D. Dissertation, Ohio State University, Ohio, 1982.

Panzar, John C., and Robert D. Willig, "Economies of Scale in Multi-Output Production", Quarterly Journal of Economics, (August 1977), 481-493.

Panzar, John C., and Robert D. Willig, "Economies of Scope", American Economic Review, 71 (May 1981), 268-272.

Ray, Subhash C., "A Translog Cost Function Analysis of U.S. Agriculture, 1939-77", American Journal of Agricultural Economics, 64 (August 1982), 490-498.

Uzawa, Hirofumi, "Production Functions with Constant Elasticities of Substitution", Rev. Econ. Stud., 29 (October 1962), 291-299.

Appendix

Table A.1. Development Bank: Estimated Parameters of the Cost Function, Including Loan-Size and Deposit-Size Effects. System Estimation with Two Output Definitions[a/]

	Model (output definition)			
	(1) Number of Loans (q_1), Number of Deposit Accounts (q_2)		(2) Value of Loans (q_1), Deposit Balances (q_2)	
Parameter (Variable)	Estimate	t-ratio (asymptotic)	Estimate	t-ratio (asymptotic)
α_0 (intercept)	1.6131	0.941	6.0005	11.489*
α_1 ($\ln q_1$, loans)	-0.3023	-1.117	0.5814	5.787*
α_2 ($\ln q_2$, deposits)	0.4123	0.769	-0.6449	-3.203*
β_1 ($\ln p_1$, price of labor)	0.6710	6.793	0.5585	10.192*
β_2 ($\ln p_2$, price of capital)	0.3290	3.331*	0.4415	8.056*
γ_{11} $(\ln q_1)^2$	0.1116	4.046*	0.1463	8.835*
γ_{22} $(\ln q_2)^2$	0.0027	0.023	0.2619	4.799*
γ_{12} ($\ln q_1 \ln q_2$)	-0.0226	-0.365	-0.0646	-2.693*
δ_{11} $(\ln p_1)^2$	0.0479	5.564*	0.0756	8.041*
δ_{22} $(\ln p_2)^2$	0.0479	5.564*	0.0756	8.041*
δ_{12} ($\ln p_1 \ln p_2$)	-0.0479	-5.564*	-0.0756	-8.041*
η_{11} ($\ln q_1 \ln p_1$)	-0.0445	-5.513*	-0.0766	-9.542*
η_{12} ($\ln q_1 \ln p_2$)	0.0445	5.513*	0.0766	9.542*
η_{21} ($\ln q_2 \ln p_1$)	-0.0356	-1.932†	-0.0103	-0.858
η_{22} ($\ln q_2 \ln p_2$)	0.0356	1.932†	0.0103	0.858
θ_1 ($\ln q_1$ lnLS, loan-size interaction)	0.0858	19.505*	-0.0091	-2.332†
θ_2 ($\ln q_2$ lnDS, deposit-size interaction)	0.0527	9.786*	-0.0180	-1.950†
R^2	0.8955[b/]	---	0.8858[b/]	---
F-value	76.03		68.86	
Weighted R^2 (system)	0.7848		0.8168	

a/ Factor-price homogeneity and cross-equations restrictions imposed on estimation. DFS=304.
Significance levels: *, .01; †, .05.

b/ R^2 of labor-share equation: Model (1) = 0.2775 (F = 14.79)
Model (2) = 0.3116 (F = 17.42)

Table A.2. Private Bank: Estimated Parameters of the Cost Function, Including Deposit-Size Effects. Single Equation versus System Estimation.[a/]

	(1) Single Equation (OLS)		(2) System of Equations (GLS)	
Parameter (Variable)	Estimate	t-ratio	Estimate	t-ratio (asymptotic)
α_0 (intercept)	-3.1379	-1.307	-3.0242	-1.324
α_1 ($\ln q_1$, loans)	-0.5526	-1.572	-0.7300	-2.184†
α_2 ($\ln q_2$, deposits)	1.3148	2.621*	1.3405	2.805*
β_1 ($\ln p_1$, price of labor)	1.4563	2.673*	1.5913	3.071*
β_2 ($\ln p_2$, price of capital)	-0.4563	-0.837	-0.5913	-1.141
γ_{11} $(\ln q_1)^2$	0.0040	0.098	0.0110	0.284
γ_{22} $(\ln q_2)^2$	-0.0567	-0.777	-0.0142	-0.205
γ_{12} $(\ln q_1 \ln q_2)$	0.1384	1.535	0.1134	1.323
δ_{11} $(\ln p_1)^2$	-0.0404	-0.542	-0.0508	-0.715
δ_{22} $(\ln p_2)^2$	-0.0404	-0.542	-0.0508	-0.715
δ_{12} $(\ln p_1 \ln p_2)$	0.0404	0.542	0.0508	0.715
η_{11} $(\ln q_1 \ln p_1)$	0.0064	0.138	0.0366	0.829
η_{12} $(\ln q_1 \ln p_2)$	-0.0064	-0.138	-0.0366	-0.829
η_{21} $(\ln q_2 \ln p_1)$	-0.0538	-0.872	-0.0894	-1.522
η_{22} $(\ln q_2 \ln p_2)$	0.0538	0.872	0.0894	1.522
θ_2 ($\ln q_2 \ln DS$, deposit-size interaction)	-0.0227	-2.768*	-0.0247	-3.169*
R^2	0.9745	---	0.9769[b/]	---
F-value	684.92*		489.52*	
Weighted R^2 (system)	---		0.9562	

a/ Factor-price homogeneity restrictions imposed on estimation. N=190. DFS = 365. Significance levels: *, .01; †, .05.

b/ R^2 of labor-share equation: 0.3590, F-ratio = 25.90.

Table A.3. Development Bank: Estimated Parameters of the Cost Function. Output Defined as Value of Loans (q_1) and Deposit Balances (q_2). Single Equation versus System Estimation.[a/]

	(1) Single Equation (OLS)		(2) System of Equations (GLS)	
Parameter (Variable)	Estimate	t-ratio	Estimate	t-ratio (asymptotic)
α_0 (intercept)	5.3210	9.817*	4.7545	14.219*
α_1 ($\ln q_1$, value of loans)	0.1439	1.153	0.3434	4.890*
α_2 ($\ln q_2$, deposit balances)	0.0163	0.101	-0.1037	-1.188
β_1 ($\ln p_1$, price of labor)	0.5439	3.399*	0.5776	14.385*
β_2 ($\ln p_2$, price of capital)	0.4561	2.851*	0.4224	10.518*
γ_{11} $(\ln q_1)^2$	0.0931	3.388*	0.1351	10.502*
γ_{22} $(\ln q_2)^2$	-0.0429	-1.211	0.0967	4.756*
γ_{12} $(\ln q_1 \ln q_2)$	-0.0063	-0.257	-0.0113	-0.723
δ_{11} $(\ln p_1)^2$	0.0003	0.007	0.1022	13.729*
δ_{22} $(\ln p_2)^2$	0.0003	0.007	0.1022	13.729*
δ_{12} $(\ln p_1 \ln p_2)$	-0.0003	-0.007	-0.1022	-13.729*
η_{11} $(\ln q_1 \ln p_1)$	-0.0426	-1.255	-0.0954	-14.914*
η_{12} $(\ln q_1 \ln p_2)$	0.0426	1.255	0.0954	14.914*
η_{21} $(\ln q_2 \ln p_1)$	0.0922	2.786*	-0.0169	-2.029†
η_{22} $(\ln q_2 \ln p_2)$	-0.0922	-2.786*	0.0169	2.029†
R^2	0.8491	---	0.8586[b/]	---
F-value	173.86*		117.51*	
Weighted R^2 (system)			0.7331	

a/ Factor-price homogeneity restrictions imposed on all estimated equations. Cross-equations restrictions imposed on system estimation. N=288. DFS=562. Significance levels: *, .01; †, .05.

b/ R^2 of labor-share equation: 0.2886, F-ratio = 28.50.

Table A.4. Private Bank: Estimated Parameters of the Cost Function, Single Equation versus System Estimation.[a/]

Parameter (Variable)	(1) Single Equation (OLS) Estimate	(1) Single Equation (OLS) t-ratio	(2) System of Equations (GLS) Estimate	(2) System of Equations (GLS) t-ratio (asymptotic)
α_0 (intercept)	-4.0332	-1.665°	-4.0121	-1.728°
α_1 ($\ln q_1$, loans)	-0.7159	-2.029†	-0.8772	-2.595*
α_2 ($\ln q_2$, deposits)	1.4888	2.938*	1.5261	3.139*
β_1 ($\ln p_1$, price of labor)	1.5403	2.780*	1.6593	3.126*
β_2 ($\ln p_2$, price of capital)	-0.5403	-0.975	-0.6593	-1.242
γ_{11} $(\ln q_1)^2$	0.0097	0.236	0.0160	0.404
γ_{22} $(\ln q_2)^2$	-0.0584	-0.785	-0.0232	-0.325
γ_{12} $(\ln q_1 \ln q_2)$	0.1154	1.262	0.0928	1.060
δ_{11} $(\ln p_1)^2$	-0.0481	-0.633	-0.0572	-0.785
δ_{22} $(\ln p_2)^2$	-0.0481	-0.633	-0.0572	-0.785
δ_{12} $(\ln p_1 \ln p_2)$	0.0481	0.633	0.0572	0.785
η_{11} $(\ln q_1 \ln p_1)$	0.0323	0.697	0.0596	1.343
η_{12} $(\ln q_1 \ln p_2)$	-0.0323	-0.697	-0.0596	-1.343
η_{21} $(\ln q_2 \ln p_1)$	-0.0825	-1.331	-0.1146	-1.928†
η_{22} $(\ln q_2 \ln p_2)$	0.0825	1.331	0.1146	1.928†
R^2	0.9734	---	0.9758[b/]	---
F-value	733.04*		503.31*	
Weighted R^2 (system)	---		0.9536	

a/ Factor-price homogeneity restrictions imposed on estimation.
N=190. DFS=365.
Significance levels: *, .01; †, .05; °, .10.

b/ R^2 of labor-share equation: 0.3590, F-ratio = 25.90.